Decayed, Missing, or Filled Permanent Tooth Surfaces Index

Procedure & Method Information

Name of Procedure/Method Decayed, Missing, or Filled Permanent Tooth Surfaces Index *Abbreviation* DMFS

Purpose To assess the prevalence of coronal caries (i.e., cavities).

Year of Establishment 1938 *Type of Procedure/Method*

Developer(s) H.T. Klein, C.E. Palmer, and J.W. Knutson *Oral Condition Category*

Background Information

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The Decayed, Missing, or Filled Permanent Tooth Surfaces (DMFS) Index was originally developed in 1938 by H.T. Klein, C.E. Palmer, and J.W. Knutson along with the Decayed, Missing, or Filled Permanent Teeth (DMFT) Index to assess the prevalence of coronal caries (i.e., cavities).

The DMFS Index has three components, the D-component for "Decayed," the M-component for "Missing," and the F-component for "Filled," except that the DMFS is a more detailed index than the DMFT by summing the total number of decayed, missing, and filled permanent tooth surfaces. Its primary dentition equivalent, the defs, is referred to in lowercase lettering, where "e" indicates "extracted tooth."

As in the case of the DMFT Index, the DMFS index is simple and versatile, has practically universal acceptance, and is one of the best known dental indices today (Burt and Eklund, 1999). It is calculated for each subject and can be averaged over subsets of the population.

Changes Over Time None

Procedure Method

Procedure Method

To obtain the DMFS Index, the examiner, with proper lighting and using a No. 3 plain mirror and a fine-pointed pig-tail explorer, will determine the sum of how many tooth sufaces are:

"Decayed,"
"Missing" or extracted due to decay, and
"Filled" with either a permanent or temporary restoration as a result of caries involvement.

A surface with both caries and a filling is scored as "Decayed" or "D." For permanent

dentition, the maximum score for the DMFS is 128 (i.e., surfaces) for 28 teeth or 148 for 32 teeth. Molars and premolars are considered as having five surfaces, and front teeth have four.

Primary dentition has a maximum number of 20 teeth, so the maximum score for the defs is 88.

Established Modifications

Procedural modifications can be made to the DMFS index to allow for factors such as secondary caries, crowned teeth, bridge pontics, and any other particular attribute required for study. To save time in large surveys, the DMFS can be used half-mouth, applied to opposite diagonal quadrants and the score doubled, an approach that assumes that caries incidence is bilateral (Burt and Eklund, 1999).

In addition, over time, the defs index has been modified to include the dmfs index and dfs index. The dmfs index is used on children before the ages of exfoliation or applied only to the primary molar teeth. The dfs index is numerically the same as the defs index, except that the defs allows for two grades of caries (Burt and Eklund, 1999).

Federal Survey Modifications

Note: This section includes extracts from "Oral Health Surveys of the National Institute of Dental Research: Diagnostic Criteria and Procedures" and focuses on the following Federal surveys:

- NIDR National Dental Caries Prevalence Survey, 1979-80
- NIDR National Survey of Oral Health in U.S. Employed Adults and Seniors, 1985-86
- NIDR National Survey of Oral Health in U.S. School Children, 1986-87
- National Health and Nutrition Examination Survey (NHANES) III, 1988-1994
- National Health and Nutrition Examination Survey (NHANES) IV, 1998-2004

The diagnostic criteria for determining coronal caries for the National Institute of Dental Research (NIDR) surveys and National Health and Nutrition Examination Surveys (NHANES) are:

The D (decayed) component of the DMFS assessment is diagnosed as:

Advanced lesions are detected as gross cavitation and present few problems in diagnosis. However, incipient or early lesions are more difficult to diagnose consistently and may be subdivided into three categories according to location, each with special diagnostic considerations. The categories are:

1. Pits and fissures on occlusal, buccal, and lingual surfaces:

These areas are diagnosed as carious when the explorer catches after insertion with moderate to firm pressure and when the catch is accompanied by one or more of the following signs of decay:

(1) Softness at the base of the area.

(2) Opacity adjacent to the area providing evidence of undermining or demineralization.

(3) Softened enamel adjacent to the area which may be scraped away with the explorer. (This criterion was noted in NIDR National Dental Caries

Prevalence Survey, 1979-80 and NIDR National Survey of Oral in U.S Adults and Seniors, 1985-86.)

In other words, a deep pit or fissure in which the explorer catches is not in itself sufficient evidence of decay; it must be accompanied by at least one of the above-named signs.

2. Smooth areas on buccal (labial) or lingual surfaces:

These areas are carious if they are decalcified or if there is a white spot as evidence of subsurface demineralization and if the area is found to be soft by:

(1) Penetration with the explorer, or

(2) Scraping away the enamel with the explorer. (Care should be taken to avoid removing enamel that could be remineralized.)

These areas should be diagnosed as sound when there is only visual evidence of demineralization, but no evidence of softness.

3. Proximal surfaces:

For areas exposed to direct visual and tactile examination, as when there is no adjacent tooth, the criteria are the same as those for smooth areas on buccal (facial) or lingual surfaces.

For areas not available to direct visual and tactile examination, the following criterion applies: A discontinuity of the enamel in which the explorer will catch is carious if there is softness. In posterior teeth, visual evidence of undermining under a marginal ridge is not acceptable evidence of a proximal lesion unless a surface break can be entered with the explorer. In the anterior teeth, however, transillumination can serve as a useful aid in discovering proximal lesions. Transillumination is achieved by placing a mirror lingually and positioning the examining light so that it passes through the teeth and reflects into the mirror. A characteristic shadow or loss of translucency seen on the proximal surface is indicative of caries on the surface. Ideally, the actual diagnosis should be confirmed with the explorer; however, clear visualization of a lesion by transillumination can justify a positive diagnosis.

Missing Teeth (the M component of the index)

The M (missing) component of the DMFS assessment represents those permanent teeth that have been extracted as a result of caries. It is essential, therefore, to distinguish between teeth extracted because of caries and those extracted or missing for other reasons.

Among all the Federal surveys mentioned above, the NIDR National Dental Caries Prevalence Survey, 1979-80, was the only survey that distinguished between teeth missing for caries and periodontal disease. The remainder of the surveys grouped and coded these two categories (i.e., caries and periodontal disease) together. For further explanation, see the following diagnostic codes for each survey.

Filled Tooth Surface (the F component of the index)

The F component represents a tooth surface that has been filled, with either a permanent or temporary filling, as a result of caries involvement. Here also it is necessary to distinguish between surfaces restored for caries and those restored for other reasons, such as trauma, hypoplasia, or malformation.

In addition, the following scoring guidelines have been adopted in the interest of diagnostic consistency:

1. Incisal edges of anterior teeth are not considered to be separate surfaces. If a lesion or restoration is confined solely to the incisal edge, its score should be assigned to the nearest adjacent surface. Thus, anterior teeth have only four scorable surfaces (mesial, distal, labial, and lingual). The inclusion of the occlusal surface for posterior teeth gives those teeth five surfaces. Therefore, a total of 128 surfaces are examined and diagnosed for each subject. In NHANES IV, it is noted to code the lesion as lingual if it is equidistant from the surfaces.

2. When a filling or a lesion on a posterior tooth, or a caries lesion on an anterior tooth extends beyond the line angle onto another surface, then the other surface is also scored as affected. However, a proximal filling on an anterior tooth is not considered to involve the adjacent labial or lingual surface unless it extends at least one-third of the distance to the opposite proximal surface. The reason for this criterion is that tooth structure on adjacent surfaces must often be removed to provide access for the restoration of a proximal lesion on anterior teeth. Also, to guard against a similar possibility for overestimating the amount of disease in posterior teeth, a proximal restoration should extend at least a millimeter past the line angle before it is considered to involve the adjacent buccal or lingual surface.

3. If a permanent tooth has a full crown restoration placed because of caries, the tooth will be coded as "crown" (e.g., "C"), which represents the maximum number of surfaces for the tooth type, i.e., four surfaces on anterior teeth and five surfaces on posterior teeth. By convention, all crowns on posterior teeth, including abutment teeth for fixed or removable prostheses, are considered to have been placed as a result of caries. On anterior teeth, however, the examiner should determine the reason for crown placement. If a crown was placed for any reason other than caries, such as fracture, malformation, or esthetics, the tooth is coded "excluded" (e.g., "Y"). This rule applies only to permanent teeth with full crowns or jackets. If a tooth has been restored with less than full coverage, all surfaces not involved should be scored in the usual manner. However, in NHANES IV for three-quarter crowns, it stated that when crown coverage extends onto the labial/buccal or lingual surface for cusp protection, the surface is not scored as restored unless coverage extends more than two millimeters cervically from the cusp tip or incisal edge.

4. Teeth that are banded or bracketed for orthodontic treatment are examined in the usual manner, and all visible surfaces are scored.

5. Certain teeth, notably first bicuspids may have been extracted as part of orthodontic treatment. These teeth are coded "missing" (e.g., "M") and will be excluded from the DMFS analysis. The examiner must determine that the teeth were extracted for orthodontic reasons rather than caries, although this is not usually difficult because of

the typically symmetric pattern of these extractions. For the sake of uniformity, all orthodontically extracted bicuspids are scored as first bicuspids. Teeth other than bicuspids may also be extracted for orthodontic reasons. In many cases the subject will have good recall of the reason for the extractions and can help make the correct determination.

6. Non-vital teeth are scored in the same manner as vital teeth. If, however, a restoration on a non-vital tooth was placed solely to seal a root canal and not for caries, that restoration will not be scored. If no other lesions or restorations are present, the tooth will be called sound.

7. Hypoplastic teeth are scored in the usual manner. However, if a restoration on such a tooth was placed solely for esthetic reasons and not for caries, that restoration will not be scored. If a hypoplastic tooth is restored with a full crown, it is to be coded as "excluded" (e.g., "Y").

8. Malformed teeth are scored in the usual manner except when they have been restored with a full crown for esthetic reasons, in which case they are coded as "excluded" (e.g., "Y").

9. When the tooth crown is destroyed by caries and only the roots remain, score all surfaces carious (e.g., X, 0, 1, 2, 3 on posterior teeth and 0, 1, 2, 3 on anteriors).

10. In general, when the same tooth surface is both carious and filled, only the caries is called. Note that only one call may be made for a given surface. If two or more conditions exist on the same surface, then caries receives precedence over a restoration. When a filling is examined for recurrent caries, a defective filling is not considered carious in the absence of definitive visual and tactile criteria for caries.

    However, in NIDR National Survey of Oral Health in U.S. Employed Adults and Seniors, 1985-86, when a surface was both carious and restored, both conditions were noted. And if caries was contiguous with a restoration, a "recurrent caries" call was made using double numerical notation (i.e., 55, 66, 77, 88, or 99). Therefore, it was possible to have more than one call per surface. For example, an occlusal surface with a new caries lesion, a sound restoration, and a restored area with recurrent decay was coded for all three conditions (i.e., X, 5, 55).

11. Fractured or missing restorations are scored as if the restoration were intact. If caries is found within or adjacent to the margins of a fractured or missing restoration, caries should be scored. (Criteria are not noted in NIDR National Dental Caries Prevalence Survey, 1979-80 and NIDR National Survey of Oral Health in U.S. Employed Adults and Seniors, 1985-86.)

12. In the case of supernumerary teeth, only one tooth is called for the tooth space. The examiner must decide which tooth is the "legitimate" occupant of the space.

13. If both a deciduous and a permanent tooth occupy the same tooth space, only the permanent tooth is scored.

14. Third-year molars are not scored. When examining second molars it is important to note that a drifted third molar may occupy the space of a missing second molar. In such cases, the diagnosis and call must relate to the status of the missing second molar, not the third molar. If the second molar, for example, was extracted because of caries and the space is now occupied by a sound third molar, the second molar is scored as "extracted" (e.g., code "E"), and the third molar is not scored.

15. A tooth is considered to be in eruption when any part of its crown projects through the gum. This criterion is easier to standardize than one that calls for a more advanced stage of eruption.

16. Stain and pigmentation alone should not be regarded as evidence of decay since either can occur on sound teeth.

For the dmfs, decayed and/or filled surfaces of primary or deciduous teeth are scored in the same manner as permanent teeth, using the same diagnostic criteria as stated above. When scoring deciduous teeth, it is necessary to precede the surface calls for deciduous teeth with a "deciduous" call (e.g., code "D") to distinguish them from permanent teeth. The "deciduous" code is combined with any other appropriate diagnostic call for decayed or filled surfaces. For example, if a deciduous molar has occlusal caries and is otherwise sound, the "deciduous" code is combined with the code for occlusal caries (e.g., "D,X"). The diagnostic procedures are exactly the same as for permanent teeth except that the "deciduous" code (e.g., code "D") precedes the surface call/code, and if the deciduous tooth is sound, the "deciduous" code (e.g., code "D") is used alone. All missing deciduous teeth are scored as unerupted permanent teeth (e.g., code "U") to avoid potential problems with scoring since it is often not possible to distinguish exfoliated teeth from teeth extracted due to caries, especially when dentition is mixed. Later in the analysis phase, the age of the child is used to determine the most likely reason for tooth loss.

When conducting the examination for the DMFS Index, an effort should be made to examine each subject in the same manner, regardless of the amount of tooth decay (i.e., caries) or prior treatment. For the DMFS Index, the subject should be examined with a sharp #23 explorer and an unmarred, nonmagnifying, front surface mouth mirror. The teeth should also be dried before each quadrant is examined. In addition, the recorder should be positioned within easy hearing distance of the examiner. The examination sequence should follow the same sequence as shown on the data forms. The forms are arranged by quadrants; the examiner should start with upper left central incisor and continue distally through the second molar in the same quadrant. The same sequence is followed for the upper right, lower left, and lower right quadrants, in that order. It is also necessary to examine each individual tooth in a systematic approach. It is suggested that the surfaces be examined in the following order: lingual, labial, mesial, and distal for anterior teeth, and occlusal, lingual, buccal, mesial, and distal for posterior teeth. However, in NHANES IV, the examination sequence changed. The examination started in the upper right quadrant and continued to the upper left, lower left, and lower right. The tooth surface examination for posterior teeth also changed to lingual, occlusal, buccal, mesial, and distal. It is not advisable to call out individual surface codes as each tooth surface is examined, as this is confusing to the recorder. It is better if the examiner accumulates the diagnostic codes in his or her memory for a given tooth until all surfaces have been examined before dictating the diagnostic codes to the recorder. For the DMFS, the maximum number will be 128 surfaces for 28 teeth since the third-year molars or "wisdom" teeth are not scored for this index. For the

previous mentioned Federal surveys, the diagnostic codes for the DMFS Index are as follows:

NIDR National Dental Caries Prevalence Survey, 1979-80

Tooth and Surface Status Call Codes

1 (5) - All primary (permanent) tooth surfaces are scored sound.
2 (6) - At least one primary (permanent) tooth surface is decayed.
3 (7) - At least one primary (permanent) tooth surface is filled; the other tooth surfaces are caries free.
4 - All tooth surfaces are scored unerupted permanent.
8 - All permanent tooth surfaces are scored missing due to caries.
9 - All permanent tooth surfaces are scored missing for other than caries or excluded.

Source: National Institutes of Health, National Institute of Dental Research. Oral Health of United States Children: The National Dental Caries Prevalence Survey, 1979-1980. Washington, DC: U.S. Government Printing Office.

NIDR National Survey of Oral Health in U.S. Employed Adults and Seniors, 1985-86

Tooth Status Call Codes

S = Sound Crown (no caries or restorations)
R = Sound Root (no caries or restorations)
C = Full Crown Coverage
U = Unerupted
E = Missing (caries/periodontal diseases)
M = Missing (orthodontic or non-disease)
Y = Exclusion (tooth, root cannot be scored)

Surface Status Call Codes

Caries
X = Occlusal Surface
0 = Lingual Surface
1 = Buccal Surface
2 = Mesial Surface
3 = Distal Surface

Restorations
5 = Occlusal Surface
6 = Lingual Surface
7 = Buccal Surface
8 = Mesial Surface
9 = Distal Surface

Recurrent Caries
55 = Occlusal Surface

66 = Lingual Surface
77 = Buccal Surface
88 = Mesial Surface
99 = Distal Surface

Note: There is no occlusal code, i.e., X or 5 for root surfaces or for the crowns of anterior teeth.

Source: National Institutes of Health, National Institute of Dental Research. The National Survey of Oral Health in U.S. Employed Adults and Seniors, 1985-1986. Washington, DC: U.S. Government Printing Office.

NIDR National Survey of Oral Health in U.S. School Children, 1986-87

Tooth Status Call Codes

S = Sound Permanent Tooth (no caries or restorations)
D = Sound Deciduous Tooth (no caries or restorations)
C = Full Crown Coverage
U = Unerupted
E = Missing (caries/periodontal diseases)
M = Missing (orthodontic or non-disease)
Y = Exclusion

Surface Status Call Codes

Caries
X = Occlusal Surface
0 = Lingual Surface
1 = Buccal Surface
2 = Mesial Surface
3 = Distal Surface

Restorations
5 = Occlusal Surface
6 = Lingual Surface
7 = Buccal Surface
8 = Mesial Surface
9 = Distal Surface

Note: There is no code X or 5 for anterior teeth.

Source: National Institutes of Health, National Institute of Dental Research. Oral Health of United States Children: The National Survey of Oral Health in U.S. School Children, 1986-1987. Washington, DC: U.S. Government Printing Office, 1992.

National Health and Nutrition Examination Survey (NHANES) III, 1988-1994

Tooth Status Call Codes

S = Sound Permanent Tooth (no caries or restorations)
D = Sound Deciduous Tooth (no caries or restorations)
K = Deciduous Tooth with restoration or caries
C = Full Crown Coverage
U = Unerupted
E = Missing without replacements (due to caries/periodontal diseases)
M = Missing without replacements (due to other reasons)
ER = Missing with prosthetic replacements (due to caries/periodontal diseases)
MR = Missing with prosthetic replacements (due to other reasons)
Y = Exclusion

Surface Status Call Codes

Caries
X = Occlusal Surface
0 = Lingual Surface
1 = Buccal Surface
2 = Mesial Surface
3 = Distal Surface

Restorations
5 = Occlusal Surface
6 = Lingual Surface
7 = Buccal Surface
8 = Mesial Surface
9 = Distal Surface

Note: There is no code X or 5 for anterior teeth. For deciduous teeth, call "K" prior to surface status codes.

Source: National Center for Health Statistics. National Health and Nutrition Examination Survey III, 1988-1994. Washington, DC: U.S. Government Printing Office.

National Health and Nutrition Examination Survey (NHANES) IV, 1998-2004

Tooth Status Call Codes

S = Sound Permanent Tooth (no caries or restorations)
Z = Permanent Tooth with surface condition
D = Sound Deciduous Tooth (no caries or restorations)
K = Deciduous Tooth with surface condition
C = Full Crown Coverage
U = Unerupted
E = Missing due to dental disease (caries/periodontal diseases)
M = Missing due to other causes (orthodontic/traumatic or other non-disease)

R = Missing due to dental disease but replaced
X = Missing due to other causes but replaced
Y = Tooth present, condition cannot be assessed

Surface Status Call Codes

Caries
0 = Lingual Surface
1 = Occlusal Surface
2 = Buccal Surface
3 = Mesial Surface
4 = Distal Surface

Restorations
5 = Lingual Surface
6 = Occlusal Surface
7 = Buccal Surface
8 = Mesial Surface
9 = Distal Surface

Note: There is no code 1 or 6 for anterior teeth. Call "Z" prior to surface status codes for permanent teeth and "K" for deciduous teeth.

Soure: National Center for Health Statistics. National Health and Nutrition Examination Survey IV, 1998-2004. Washington, DC: U.S. Government Printing Office.

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Validaty

Reliability

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